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Selective laser spectroscopy of Mn4+-Mn4+ pair centers in SrTiO3 crystal

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Abstract

Zero-phonon lines of a pair center of Mn4+ ions are observed in the luminescence and luminescence-excitation spectra of SrTiO3:Mn crystal. Based on the experimental data, the energy-level structure of the ground state |4 A2g,4 A2g and excited state |4 A2g,2 Eg of the Mn4+-Mn4+ pair center is constructed. It is shown that the exchange interaction in the ground state of the Mn4+-Mn 4+ pair is antiferromagnetic. Energies of the levels are calculated assuming that the pair is formed by Mn4+ ions occupying neighboring octahedral positions of Ti4+ ions along the [110] axis. Experimental values of the exchange integral in the ground state |4 A 2g,4 A2g and energies of spin multiplets in the excited state |4 A2g,2 E g agree well with calculation of the exchange interaction carried out within the framework of the channel model with the parameters J ξη = 32 cm4-1 and Jζζ = -45.5 cm4-1. Experimental data and calculations unambiguously demonstrate that zero-phonon lines in the luminescence and luminescence-excitation spectra have magnetic-dipole nature. © 2014 Pleiades Publishing, Ltd.

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